A STUDY OF INSPECTION AND QUALITY CONTROL
at the
OVERHAUL AND REPAIR DEPARTMENT
U.S. NAVAL AIR STATION
QUONSET POINT, RHODE ISLAND

by

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INTRODUCTION

On October 10, 1956, the Navy's Bureau of Aeronautics* promulgated the "Management Control System Manual" for use by Aircraft Overhaul and Repair Departments located at Major Air Stations throughout the country. The Manual established a complete integration of all Management Improvement Programs such as Production Control, Engineering Performance Standards, Material Control and Cost Control and was later expanded to include Industrial Funding and Quality Control.

The Quality Control Program was implemented at the Quonset Point Naval Air Station, Rhode Island, on December 15, 1959 at which time the Inspection Group became the Quality Control Group. This organizational change was only one of many affecting the inspection function through the years and lends itself to an historical study of inspection and quality control procedures as devised by management for a military aircraft repair facility.

The objective of this paper is to study the inspection and quality control programs as they have evolved at the Quonset Point Overhaul Facility. An attempt will be made to explain the "why" as well as the "when" of certain events in order that a better understanding of managerial decisions affecting inspection

*On January 1, 1960, the Bureau of Aeronautics was merged with the Bureau of Ordnance and renamed the Bureau of Naval Weapons.

and product quality may be provided.

It is re-emphasized that the Quality Control Program is just one segment of the Management Control System and, in itself, indicates the progress Navy Command has made in the field of scientific management.

CHAPTER I

THE NAVAL AIR STATION

In the strategic planning of the pre-World War II era, the Navy began to build its fighting machine around the aircraft carrier and the seaplane. It developed a plan for the strategic location of air stations with fleet loading potential for the carriers, sea room for the seaplanes, and repair facilities for all types of aircraft. Since military appropriations were small, the Navy concentrated its air power at two main bases -- Norfolk, Virginia, which serviced Atlantic Ocean aircraft and another at San Diego, California, which serviced Pacific Ocean aircraft. A third important base, where major flight training for prospective Naval Aviators was conducted, was established at Pensacola, Florida.

Assembly and Repair Departments

At each of these stations, functioning shops for the purpose of overhauling and repairing aircraft were established. These were called Assembly and Repair Departments and provided the main source of aircraft readiness and training of Naval maintenance personnel.

The Assembly and Repair Departments played an important role in aircraft operations because aircraft had to be overhauled

at specified times, scheduled in advance by the Bureau of Aeronautics. Operating squadrons were able to provide general maintenance and minor repair but could not conduct complete disassembly and processing of all components such as engines, propellers, fuselage, etc. Therefore, just as surface warships returned to the shipyard for repair, aircraft returned to the Assembly and Repair Departments for overhaul.

During the latter part of the 1930's it became apparent to Navy officials that as aircraft increased in numbers, more facilities would have to be constructed to support them. As a result, several surveys of prospective areas were made.

Quonset Point Naval Air Station

On June 7, 1938, a Naval Board headed by Rear Admiral Hepburn was authorized by Congress to study the need for and the location of new bases on the East Coast. From this study came the selection of Quonset Point, Rhode Island, as a possible base site, and in May of 1940 $24,204,000 was asked from Congress to finance the project. With National Defense playing a most important role in Congress at this time, funds were immediately provided to finance the project, and construction began at Quonset Point in July 1940. Commissioning ceremonies were held a year later on July 12, 1941.[1] It must be noted that Britain at this time was fighting the Battle of the North Atlantic, and a large Naval Air Base was needed in New England to fit our defensive purposes.

Quonset Point soon grew to be the largest Naval Air Station in the Northeast section of the country, consisting of

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[1] Visitors Guide, Overhaul and Repair Department, Quonset Point, Rhode Island, October 13, 1950, p. 1.

four runways, four landplane hangars and three seaplane hangars, a carrier pier, and buildings to provide all services for aircraft and personnel. Originally, the Commanding Officer of the Naval Air Station had nine departments under his command -- Administration, Security, Naval Air Torpedo Unit, Operations, Communications, Dental, Medical, Supply and Fiscal, and Public Works. The Assembly and Repair Department and the Inspection and Survey Department were added later.

Six weeks after the commissioning of the Naval Air Station, the vanguard of Assembly and Repair Department personnel reported for duty. Some of these people were recruited from non-Navy sources while some were transferred from the large Assembly and Repair Facility at Norfolk.

In the beginning, the Assembly and Repair Department consisted of three staff groups -- Planning, Administration and Aeronautical Engineering. The main working division was the Shops Group which was divided into seven units -- Structures, Process, Accessories, Assembly, Power Plant, Plant, and Repair and Transfer. The Department was staffed with such officers, enlisted personnel, and civilians as were assigned or approved by the Commanding Officer of the Air Station. No provision was made for inspection or quality control during the early formative stage of the organization.[2]

The Mission of the Assembly and Repair Department was to support the Integrated Aeronautical Program of the Navy by accomplishing the overhaul, repair, modification, salvage, testing

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[2]Information furnished by Walter F. Munster, Chief Inspector, Overhaul and Repair Department, Quonset Point, Rhode Island.

of engines, accessories and other related Naval aeronautical equipment. It included the limited manufacture of aircraft parts and assemblies. In addition, the Department had a schedule of Class 265 material to overhaul. This material included all types of aeronautical equipment and accessories held by the Supply and Fiscal Department which were not ready for issue and had been determined to be economical to repair.[3] After rework, this material was returned to the Supply and Fiscal Department to meet replacement demands of the operating forces.

As the war started and progressed, it became apparent that the work being turned out by the Assembly and Repair Department had to be quality assured. To perform this function, the Commanding Officer of the Air Station, with the consent of higher authority, established an Inspection and Survey Department.[4] In addition to control of quality of workmanship, this new department was charged with the responsibility for inspection functions wherever needed on the Naval Air Station.

The all-inclusive mission, composition, and problems associated with the Inspection and Survey Department will be considered in the next chapter.

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[3]Visitors Guide, Overhaul and Repair Department, Quonset Point, Rhode Island, October 13, 1950, p. 12.

[4]The Bureau of Aeronautics letter Aer-MA-156-WCM, 11907, dated January 20, 1945 which promulgated the "Tentative Manual for the Inspection and Survey Department on Naval and Marine Corps Air Stations.

CHAPTER II

THE INSPECTION AND SURVEY DEPARTMENT

The Inspection and Survey Department was organized as a separate entity from the Assembly and Repair Department. It functioned under the general concept that all items produced by the Assembly and Repair Department would be 100 per cent examined visually, dimensionally, and by test in accordance with drawings, specifications, process and test criteria.

Very little guidance or instruction was available for setting up the new Department so that from 1942 to 1944 the organization and procedures were established by the few experienced inspection personnel available. Although from March 1942 to March 1943 the Department grew from six people to two hundred and fifty (military and civilian combined), 95 per cent were without previous inspection experience.[1]

Personnel Training

Since Inspection and Survey was plagued from the start by a lack of experienced personnel, training presented many problems. For example, there was a great deal of diversification

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[1]Information supplied by Walter F. Munster, Chief Inspector, Overhaul and Repair Department, Quonset Point, Rhode Island.

work in the various shops and many journeyman trades were required to perform and inspect the workloads. Therefore, training programs had to be established and maintained.

Basic training was handled by the Training Branch of the Industrial Relations Department with instructors assigned to various shops. Candidates for inspector assignments were selected from the journeyman ranks, when possible, and from personnel who had completed their basic shop training. The Inspection and Survey Department followed this with at least three months on-the-job training after which time the new inspector was allowed to "break in" by performing limited inspection in an assigned area.

Under the "complete overhaul" concept, all aircraft components were completely disassembled, visually and dimensionally inspected, stripped, replated, refinished, and reassembled. During the entire process the inspector had to oversee the work and check test the product. With inexperienced personnel, the job consumed more time than was considered normal, but since Assembly and Repair personnel were also inexperienced, both Departments were in balance on time control.

The Inspection and Survey Department had other problems besides personnel. It inherited the job of flight testing aircraft which consisted of moving aircraft to the flight test line, preparing the aircraft for flight, and having Assembly and Repair personnel work off the discrepancies. Standard flight procedures for test were prepared by the inspectors and the officers assigned to the flight test division.

Another problem concerned the lack of information now contained in Maintenance Manuals, Pilot's Handbooks, Parts

Catalogues, Structure Repair Manuals, etc. Since the information was not readily available, the inspectors produced their own. They kept records on the different configurations of aircraft and aircraft components, processing procedures work completed on aircraft, flight test information, and log book information. Soon the Department became a record-keeping organization and retained complete information of work accomplished on aircraft. This was invaluable for historical reasons.

On January 20, 1945, the Bureau of Aeronautics issued the "Tentative Manual for the Inspection and Survey Department on Naval and Marine Corps Air Stations." This manual was promulgated by Bureau of Aeronautics letter Number Aer-MA-156-WCM, A3-1, Serial Number 11907, dated January 20, 1945, and was the first and only guide issued for Inspection and Survey Departments. Although it was "tentative," it became the standard organization for the Inspection and Survey Departments in all Naval Air Stations.

The Manual stated that the Inspection and Survey Department should be organized to render complete service to the Air Station activities concerned and should closely pattern the activity it services.

The Mission

The Inspection and Survey Department was charged with:

> Inspection for quality and conformance with applicable directives of all aviation material manufactured, modified, overhauled or repaired by the Assembly and Repair Department on the Station; inspection of airplanes to be released from the Station for ferrying; inspection of all supplies delivered to the Station from outside sources as set forth in Article 1611 through 1614, U. S. Navy

> Regulations, except provisions, medical supplies and other supplies ordinarily inspected by the department concerned; conducting surveys requested by the Supply Officer and ordered by the Commanding Officer, together with rendering proper reports thereof; furnishing technical advice and inspection service to the Supply Officer relative to handling, preservation and condition of aviation material in his custody, as required by Article 19-401, Bureau of Aeronautics Manual, and at other times when requested.[2]

Administration

The Inspection and Survey Department operated with such officers, enlisted personnel and civilians assigned and approved by the Commanding Officer. Its administration was governed by the Manual and by other directives issued by the Inspection and Survey Officer, the Commanding Officer, the Bureau of Aeronautics and other competent authority.

Duties of the Inspection and Survey Officer

The duties of the Inspection and Survey Officer were as follows:

> a. The Inspection and Survey Department shall be administered by the Inspection and Survey Officer, who is designated as such by the Commanding Officer, in accordance with U. S. Navy Regulations, Bureau of Aeronautics Manual, and such other orders and instructions as may be issued by competent authority.
>
> b. He shall be personally responsible for the efficiency and effectiveness of the entire Department. With prior approval of the Bureau of Aeronautics he shall, under the direction of the Commanding Officer, direct such improvements in organization as he considers necessary and desirable from time to time.
>
> c. He shall formulate and establish policy for the Department and shall issue such orders and directives as are necessary to insure compliance. These orders and directives shall be in accordance with existing orders and directives issued by higher authority.

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[2]Tentative Manual for the Inspection and Survey Department on Naval and Marine Corps Air Stations, January 20, 1945, p. 1.

d. He shall furnish inspection personnel with adequate and up-to-date technical information concerning inspection standards and existing approved specifications.

e. He shall render technical advice of an inspection nature to the Supply Officer, when required.

f. He shall act as a liaison officer for the Station with other units or departments on technical aviation inspection matters.

g. He shall maintain active and positive liaison with the Assembly and Repair Officer in order to attain a productive output of the proper quality and quantity.

h. He shall insure that all aircraft repaired, overhauled, or reconditioned are flight tested in strict accordance with existing regulations.

i. He shall supervise the military activities of the military personnel.[3]

The Inspection and Survey Officer was assisted by an Assistant Inspection and Survey Officer, a Supply Officer, a Flight Test Officer, an Acceptance and Transfer Officer, a Senior Civilian Administrative Inspector, a Unit Supervising Inspector, and an Overhaul Control Inspector.

The Senior Civilian Administrative Inspector supervised all inspectors in the Department and directed the office clerical force in the performance of its duties. He prepared all applicable orders, aircraft and engine changes, bulletins, technical orders and notes, specifications, correspondence and other applicable information for dissemination to the inspectors and units concerned. He reviewed all the log books on aircraft and engines reconditioned, overhauled, or repaired when submitted from the Assembly and Repair Department as complete. Finally he

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[3]Ibid., p. 1.

handled all matters pertaining to Civil Service personnel of the Department such as promotions, transfers, resignations, annual and sick leave, and preparation of efficiency ratings.[4]

Inspector Qualifications

Inspectors were expected to possess a thorough knowledge of the materials and elements of workmanship for which they were to inspect. They had to read blueprints, interpret specifications, and realize when conditions had been met. While quality was of primary importance, the inspector had to realize also that quantity of aircraft completed by the Assembly and Repair Department was of equal importance and he had to cooperate in every respect to maintain production.[5]

Methods of Inspection

The Manual specified certain methods of inspection and spelled out the responsibilities of the Assembly and Repair Department to the Inspection process:

> 1. The Assembly and Repair Department will examine all parts and assemblies prior to their being reconditioned, repaired, or overhauled. Inspectors will not inspect parts and assemblies before they are repaired, but rather, will serve in an advisory capacity relative to such repairs. Inspections will be made only after the shop supervisor has indicated that necessary work under his cognizance has been completed.
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> 2. Inspectors shall inspect parts and assemblies which are in process of reconditioning, overhaul, repair, or manufacture for the purpose of insuring compliance with approved methods and procedures.
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> 3. If, during the fabrication or assembly of parts, the inspector notices any defects, discrepancies, or poor workmanship, he shall call such

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[4] Ibid., p. 3.

[5] Ibid., p. 5.

items to the attention of the shop supervisor so that they will be corrected before the parts in question reach the inspection stage.

4. If alterations are made to any part or assembly after having been inspected and passed by an inspector, another inspection shall be conducted.

5. An inspection stamp shall be assigned to each inspector in the Inspection and Survey Department. When a stamp is lost, its number shall be withheld from use until it has definitely been established that the stamp cannot be recovered. The inspection stations shall be notified immediately when a stamp has been lost or when one has been restored to the active list.

6. When inspectors differ in opinion on the inspection of a part or assembly, the immediate supervisor shall be required to inspect the item and render a decision. In such cases the inspector who renders the decision shall stamp the item with his own stamp. After an item is inspected and stamped the inspection shall be accepted by other inspectors, unless it is obviously in error.

7. A member of the Inspection and Survey Department may act in an advisory capacity to the Assembly and Repair Department Aircraft Reconditioning Board when so required. He shall not act as a member of this Board. He shall not pass on questions of policy regarding methods and possibilities of repair, and disposition of aircraft parts and assemblies during reconditioning, overhaul, or repair.

8. Inspection may be performed in certain shops by production shop foremen if such method of inspection is satisfactory to the Inspection and Survey Officer. The size of the shop and the skill required to obtain proper inspection should be the determining factor.[6]

Relations with the Supply Department

The Inspection and Survey Department provided inspection service to the Naval Air Station Supply Department. In return for such service the Supply Department provided office space

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[6] Ibid., p. 5.

and office equipment; furnished invoices, specifications, drawings, handling services, and other necessary services required for these inspections; and furnished the inspectors with sufficient copies of all Supply Department directives relative to storage and care of aviation materials.[7]

Relations with the Assembly and Repair Department

Responsibilities of Inspection to Assembly and Repair were as follows:

> 1. The Assembly and Repair Department will examine all parts prior to processing, and will determine the procedures to be used in such processing. The Assembly and Repair Department will be responsible for the complete magnaflux operation. The Inspection and Survey Department will be responsible for the inspection of all parts during and after processing.
>
> 2. The Assembly and Repair Department will prepare reports to be affixed to the log books showing parts replaced, work accomplished, changes and bulletins incorporated. The Inspection and Survey Department will review the report of work accomplished on aircraft and engines after overhaul, modification, reconditioning, and repairs. If all entries are in order, the report will be signed or stamped by the Inspection and Survey Department.
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> 3. The Inspection and Survey Department will perform inspection in a progressive manner by inspecting each operation as it is completed, noting all discrepancies on a discrepancy sheet attached to the aircraft or engine. The Assembly and Repair Department will correct discrepancies noted by inspectors before the next group of operations is begun.
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> 4. The Assembly and Repair Department will provide sufficient areas in convenient locations in the shops for whatever inspectors are necessary to service the Assembly and Repair Department. The Assembly and Repair Department will equip these areas with the tables, chairs, and files which are required for use by inspection personnel.

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[7] Ibid., p. 6.

5. The Assembly and Repair Department will provide the Inspection and Survey Department with sufficient copies of all orders, process specifications, drawings, sketches, and other technical information and instructions issued by the Assembly and Repair Department.[8]

General Organization of the Department

The Inspection and Survey Department was organized according to the standard organization chart prepared by the Bureau of Aeronautics. The operating groups in the Department were classified as "Units," while sub-sections of each "Unit" were named "Inspection Stations." It was decreed by the Manual that the organization would conform primarily with the approved station Assembly and Repair Department organization.

The general functions and operations of the Inspection Stations in the Inspection and Survey Department indicate the scope of the overhaul operation and for this reason are outlined here:

Section	01	Disassembly
	02	Cleaning
	04	Fuselage Repair
	05	Large Surface Repair
	06	Small Surface Repair
	07	Fabric
	08	Dope
	09	Hull and Float Repair
	10	Tank Overhaul
	11	Cable and Tie Rod
	12	Electric Shop
	13	Propellers
	14	Paint
	15	Rubber Products Overhaul
	16	Hydraulic Subassembly and Installations
	17	Flight Control Installation
	18	Fuel System Installation
	19	Fixed Equipment Installation
	20	Ordnance Installation
	21	Engine Installation

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[8] Ibid., p. 6.

Section	22	Final Assembly
	23	Ground and Flight Test-Aircraft-Engine
	24	Instrument Installation
	25	Glass and Cabin Enclosures
	26	Cowling Subassembly
	27	Landing Gear Overhaul
	28	Cowling Subassembly
	29	Surface Subassembly
	30	Small Parts Subassembly
	31	Finished Parts Storage
	32	Engine Parts Reconditioning
	33	Engine Piston and Ring
	34	Engine Cylinders
	35	Engine Crankcase
	36	Engine Nose and Power
	37	Engine Blower and Rear
	38	Engine Final Check
	39	Preservation-Engine-Aircraft
	40	Auxiliary Power Units
	41	Minor Overhaul-Engine-Aircraft
	42	Instruments
	43	Oxygen and Light Gases
	44	Carbon-Dioxide and Heavy Gases
	45	Turbo-Superchargers
	46	Carburetors
	47	Pumps and Valves
	48	Starters
	49	Magnetos
	50	Spark Plugs
	51	Ignition Harness
	53	Parachutes
	54	Machine Guns
	55	Turrets
	56	Bombsights and S.B.A.E.
	57	Gun Sights
	58	Cameras
	59	Optical Equipment
	60	Bomb Racks
	61	Miscellaneous Ordnance Equipment
	62	Radio Overhaul
	63	Radar Overhaul
	64	Radio and Radar Installation and Test
	67	Tool Manufacturing
	68	Lathes and Millers
	69	Drill Presses and Grinders
	70	Screw Machines
	71	Heavy Equipment
	72	Bench Assembly
	73	Plastic Manufacture
	74	Layout and Pattern Shop
	75	Machine Operations
	76	Steel Manufacture and Welding

Section 77	Aluminum Alloy Manufacturing
78	Engine Cowl Repairs
79	Fairing Repairs
80	Tube Manufacture
81	Plating and Anodizing
82	Heat Treating
86	Joiner Shop
92	Salvage Disassembly
93	Parts Identification
94	AN Standard Parts Reclamation
95	Scrap Segregation
97	Flight Clothing
99	Shop Stores
150	Incoming Materials (Supply)
151	Materials in Storage (Supply)
152	Materials for Delivery (Supply)
153	Acceptance Line (Where Applicable)
154	Transfer Line (Where Applicable)[9]

While the "Tentative Manual for the Inspection and Survey Department" proved an organizational boon to the Inspection Department, it also pointed the way to an eventual integration of the Inspection Department and the Assembly and Repair Department. Since Inspection was actually performing a service to the Assembly and Repair Department, it was indicated that the two departments would merge at the first available opportunity.

The Merger

In 1948, as a result of post-war studies on standardization and modernization, the Assembly and Repair Department was renamed the Overhaul and Repair Department and the Inspection Department became the Inspection Group within the new Overhaul and Repair organization.[10]

From the Inspection point of view, there was one distinct advantage in the new organization -- its complement would remain fairly constant. Since the Overhaul and Repair Department

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[9]Ibid., p.a and p.b.

[10]Visitors Guide, Overhaul and Repair Department, Quonset Point, Rhode Island, October 13, 1950, p. 1.

received a separate operating allotment, distinct from Naval Air Station funds, it possessed a more stable work force. The Air Station, on the other hand, could not budget for severe winter weather where heating bills and snow removal sometimes ran over budgeted estimates. In these cases, the complement of the Inspection Department and other Naval Air Station departments were sharply reduced to make up for a rapid depletion in working funds.

On the administration side of the merger, Inspection lost prestige. Being downgraded from a department with equal status to the Overhaul and Repair Department, it now found itself a Group within the Overhaul and Repair Department. Where the Inspection Officer previously reported directly to the Executive Officer and Commanding Officer of the Station, he now reported directly to the Overhaul and Repair Officer.

The 1948 reorganization of the Overhaul and Repair Department was the first of any real consequence and marked an important milestone in military industrial management. It indicated that the military was paying considerable attention to the "scientific management" processes being implemented by private business at the time.

In the years that followed, standard organizations and control systems were developed for Overhaul and Repair Department management implementation. These were collected and developed into the "Management Control System Manual" issued in 1956. Since Inspection and Quality Control have now been included in this Manual, a discussion of the Manual and its contents is considered necessary and proper.

CHAPTER III

THE MANAGEMENT CONTROL SYSTEM

> For the past ten years (the period from 1946 to 1956), the Navy has undergone a technological revolution of a magnitude and a rate never before witnessed in the history of naval arms. Not only have atomic weapons been introduced, but also high-performance jet aircraft, complicated electronics, guided missiles, ballistic missiles, and nuclear propulsion...
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> Throughout this period, the U. S. Navy struggled with a packed Pandora's box of its own internal problems -- falling prestige of career service, aging ships, drooping enlistment rates, eroding career benefits, blossoming overseas commitments, soaring costs of naval supplies and equipment.
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> Each of these events had a profound impact on the Navy, its missions, and expanding capabilities. Each also had an effect upon the development of a naval atomic philosophy.[1]

This technical revolution carried over into the industrial plants of the Navy. "Higher aircraft speeds made demands across the board -- better instruments, new safety devices, longer runways ashore, better metals, better training, more skillful maintenance.... All of the material changes cost money." Thus economy through control became a byword within all sections of the Navy and on the maintenance side plans were unfolded for controlling costs through program management.

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[1]United States Naval Institute, Annapolis, Maryland, 1957, pp. 123, 124.

A Standard Organization

In 1951, the Bureau of Aeronautics sponsored the installation and operation of all Management Improvement Programs, and implementing processes were carried out under a gradual installation plan calculated to accomplish complete integration of all programs under a single system.[2] First came a standard organization for all Overhaul and Repair Departments.

> The degree of economy and efficiency attained in any government agency or private industrial concern may be traced directly to the alignment of its organizational structure and the pattern of responsibilities fixed for all of its segments. Without a proper organizational alignment -- a clear cut division of labor at each management level with a corresponding pattern of a single 'hat' of responsibility with authority to act for each organizational segment at each management level -- any attempt to install and operate any one or all of the principle business techniques as a system is futile.[3]

The Bureau Standard Organization for all Overhaul and Repair Departments was promulgated by BUAER Instruction 5451.12 dated September 1, 1954, as revised. The structure was mandatory at Group and Division levels in title and functions specified while necessary deviations at the Branch level were authorized with prior Bureau approval. Insofar as the system is concerned, the organization was motivated as follows:

a. Aeronautical Engineering Group: Releases specifications on how to overhaul, repair or modify work to be processed.

b. Production Engineering Group: Upon receipt of these work specifications, this group determines

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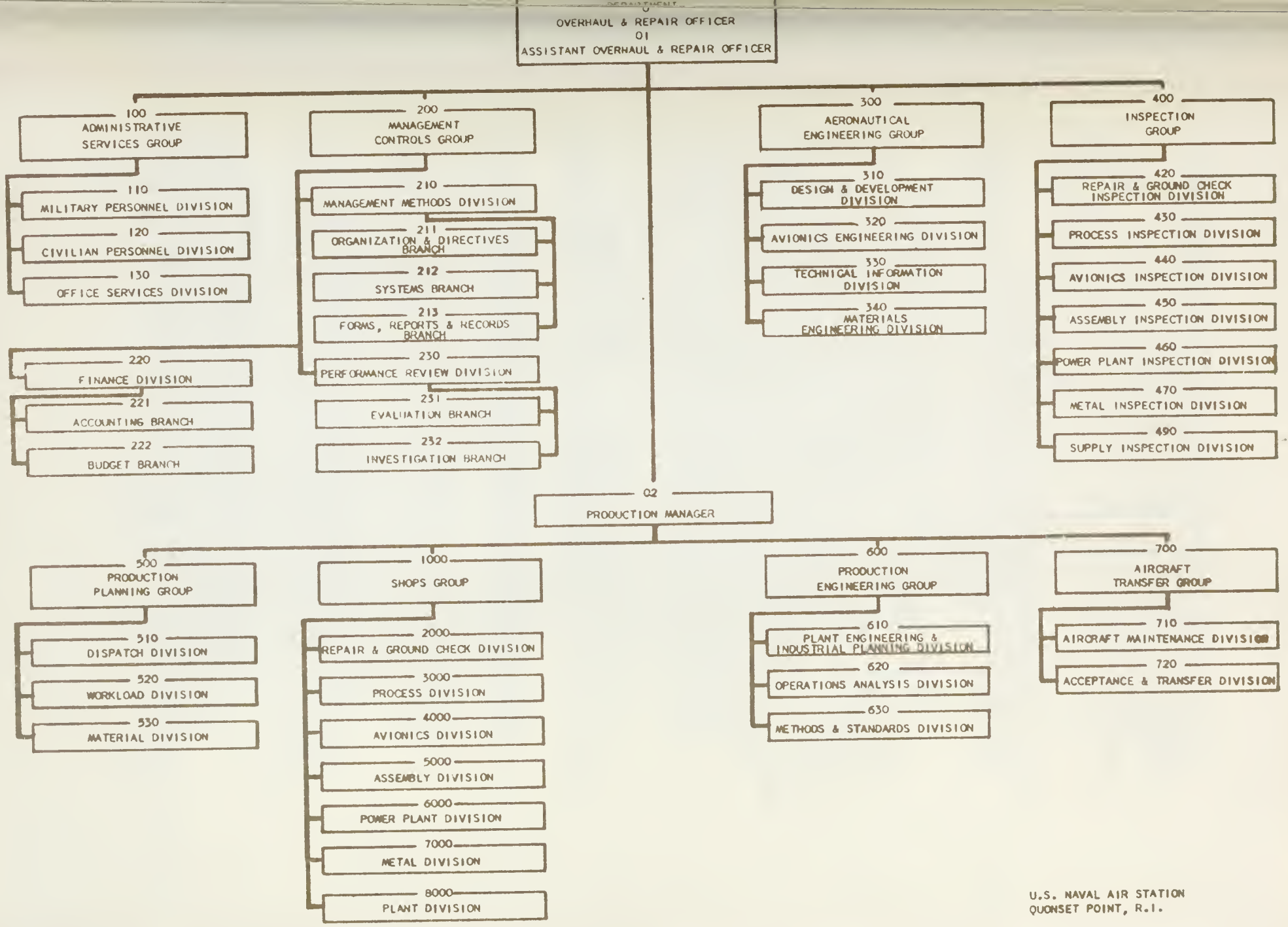
[2]Management Control System Manual, BuAer Instruction 5200.11, October 11, 1956, p. 16.

[3]Ibid., p. 2.



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where work to be processed will be performed, involving the workmanship of the following divisions:

(1) Operations Analysis Division: Identifies work to be processed in terms of assemblies, families of related assemblies and their components, the work routing sequence, elapsed work days to process, and the type of manpower, material, and facilities to be utilized.

(2) Methods and Standards Division: Utilizing the identification pattern established by the Operations Analysis Division, establishes manpower standards for each assembly identified.

c. Production Planning Group: Upon receipt of the identification pattern prescribed by the Operations Analysis Division, the Workload Division of this group determines when work to be processed is to be performed by release of Master Schedules on a program and shop basis; renders service to the Shops Group by 'executing' a schedule in terms of routing work required and to be repaired accomplished by Production Controlmen of the Dispatch Division; and finally, schedules and requisitions material availability, the responsibility of the Material Planners and Estimators of the Material Division working in concert with Production Controlmen of the Dispatch Division.

d. Shops Group: Performs overhaul, repair or modification of work in accordance with Aeronautical Engineering Group specification work.

e. Inspection Group: Inspects finished work in accordance with the Aeronautical Engineering Group work specifications.

f. Aircraft Transfer Group: Receives aircraft to be overhauled, and schedules delivery of aircraft overhauled.

g. Administration Services Group: Renders service to whole organization in terms of manpower ceilings, military and industrial relations matters, and internal and external correspondence processing.

h. Management Controls Group: Designs and installs the Management Control System and renders services to the whole organization after its operation by providing at regular intervals internal Performance Summary reports to all points of supervision, external reports on total department

effort and progress, financial status and requirement records and reports equated to workloads set by higher authority and timekeeping and technical services and equipment to facilitate the operation of the system.[4]

The System

The Management Control System established a complete integration of all Management Improvement Programs -- Production Control, Engineered Performance Standards, Material Control, Cost Control, Quality Control, and Industrial Funding. The system was "founded on the adoption of the following principles and concepts of business administration in the conduct of Overhaul and Repair Department operations:"[5]

a. 'The Principle of Identifying First Things First,' which sets the above order for installing each Management Improvement Program;

b. 'The Principle of Identifying the Depth of Control,' which requires the alignment and use of EAM documents, standard rates, and cost data for Management Control purposes on a group or 'chunk' basis of application;

c. 'The Principle of Identifying Business Technique Relationships,' requiring the integration of data generated from all Management Improvement Programs which include the commonly identified business technique titles of 'Production Control,' 'Work Simplification,' all measurement techniques ('Direct Time Study,' 'Methods Time Measurement,' 'Standard Data,' 'Multi-Man,' 'Work Sampling,' and 'Multiple Correlation'), 'Material Control,' and 'Cost Control;'

d. 'The Principle of Identifying Group Performance,' which requires a focus on an immediate supervisor and the preparation and use of standard rates and applicable time expenditures on a group accomplishment basis rather than an individual employee basis;

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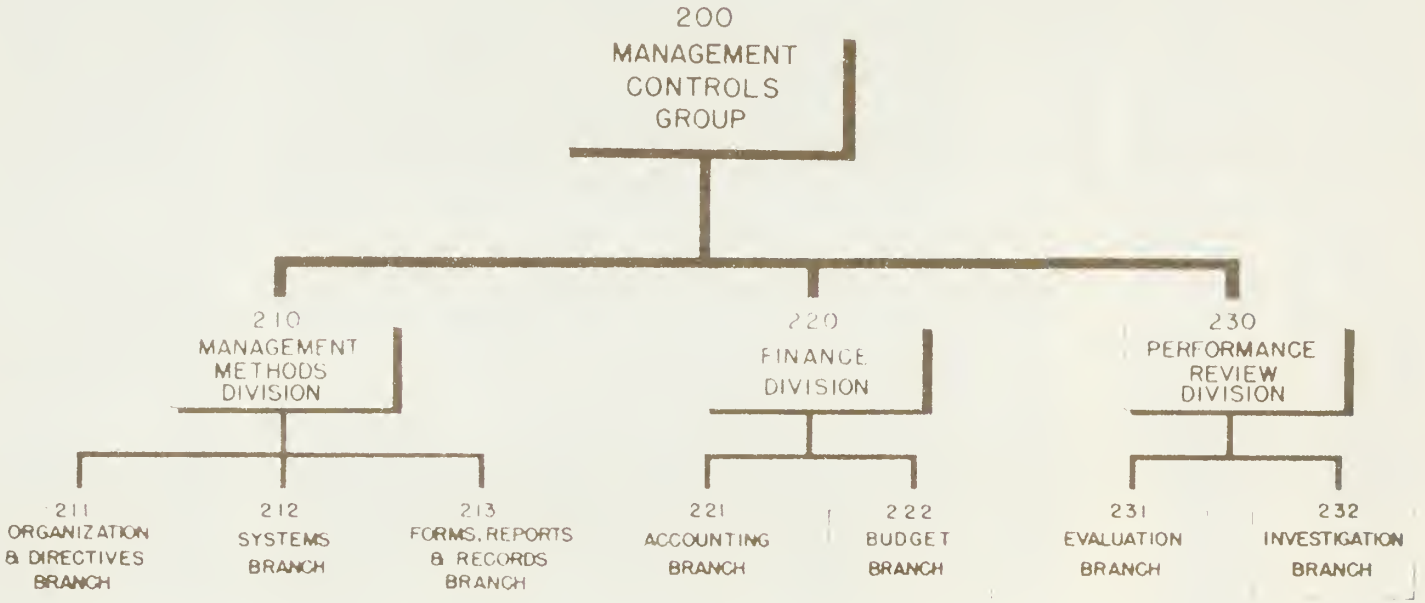
[4] Ibid., p. 2.

[5] Ibid., p. ii.

MANAGEMENT SERVICE



e. 'The concept of Coordinated Scheduling,' which requires the use of five scheduling factors to insure production shop loading to the extent of available facilities;

f. 'The Concept of Minimum Process Time,' which requires the induction, disassembly, processing, and assembly of work in an uninterrupted chain of events; and

g. 'The Concept of Examination and Evaluation,' which requires the performance of examination and evaluation during the various stages of overhaul, repair and manufacturing work.[6]

The System's Objectives

The objectives of the Management Control System were:

The first objective of the System is to control production material availability by integrating the requisitioning and usage recording procedures of an Overhaul and Repair Department with the ordering and delivery procedures of the local Supply Department, and thence with the procurement and distribution procedures of the Aviation Supply Office. These procedures were designed in a manner to pinpoint the responsibility for material shortages--the greatest waste of all production resources. The second objective of this System is to control the amount of time a supervisor devotes to supervising his workers by furnishing him with a periodic Performance Summary report reflecting his group's Production and Efficiency Indices; thus relieving him of an administrative burden calculated to average 2 hours per day without the System. A third objective of the System is to control manpower utilization by the use of standard rates which spotlight excess manpower existing in one area, for immediate transfer to another area experiencing manpower deficits.

Finally, this System is designed to control the recording, reporting and use of management data. Any management decision to increase, decrease, or project a static condition in terms of workload, people, and money is endangered by the use of fragmentary or 'tailored' statistical data. The System affords a supervisor and the executive at

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[6]Ibid., p. ii.

> any level and position in the organization with the means to make the right decision rapidly and with the assurance of maintaining the proper balance among workload, people, material, and money, in the order propounded. As a practical matter, any management official must first consider a volume of workload, then formulate manpower requirements by the use of relative standards applied against that volume of workload, and finally translate formulated requirements for manpower and material into equivalent dollars. No other sequence of consideration and determination will withstand a thorough management audit.[7]

Management Service

Management Service was invested in the Management Controls Group which had the full responsibility for the design and installation of the Management Control System:

> The Group's operation begins with 'Management Method' whereunder 'Organization and Directives' releases a directive to pinpoint the responsibility of all organizational segments. Second, 'Systems' designs procedures tailored to the pattern of responsibilities created in the first instance. Third, 'Forms, Reports and Records' create the forms, records and reports which depict the procedures design. Fourth, the 'Finance Division' operation takes over -- the 'Accounting Branch' classifies and records manpower time and dollar expenditures on the forms, records, and reports created in the third instance. Fifth, past expenditures documented by 'Accounting' provides 'Budget' with the historical base to forecast future monetary requirements equated to projected workload volumes. Finally, the dual operations of 'Performance Review' are introduced: first, determination of shop and office production and efficiency indices by 'Evaluation,' and finally, investigation of poor accomplishment trends by 'Investigation.'[8]

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[7] Ibid., p.v.

[8] Ibid., p. 6.

Quality Control and the Management Control System

On December 15, 1959, the Inspection Group of the Overhaul and Repair Department became the Quality Control Group under the Management Control System. The impact of this change is described in the next chapter.

CHAPTER IV

THE QUALITY CONTROL PROGRAM

Shortly after the promulgation of the Management Control System, a different work processing procedure for aircraft and their components was installed in the Overhaul and Repair Department. This was called the Interim Rework Program and was designed to reduce Overhaul and Repair In-process time of aircraft and their components to a specific number of days depending upon the type aircraft and the item being processed.[1]

The basic requirements for Interim Rework of aircraft consisted of a structural airframe examination, incorporation of aircraft service changes, correction of squadron reported discrepancies, and correction of other discrepancies found during the processing which would affect safety of flight conditions. The process was predicated on the fact that regular maintenance and minor repair were within the capability of the squadron maintenance department. (APPENDIX A presents excerpts from the Interim Rework Instruction.)

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[1]Bureau of Aeronautics Maintenance Representative, Eastern District, Instruction 5442.1 issued June 9, 1958.

It was conceived that at the completion of Interim Rework, an aircraft, with its power plant and accessories, would be reasonably able to perform satisfactorily for a complete service tour with a minimum requirement of replacement parts and that the safety and integrity of the aircraft would in no way be compromised.

These drastic changes in processing work presented problems in controlling quality, particularly from the inspection point of view. The Interim Rework Instruction stated that "The quality of the inspection will be as logic dictates but will attain the proper standards in order for the aircraft to operate satisfactorily for the period prior to the next rework or overhaul." This decreed that inspection determine proper standards -- a responsibility rightfully belonging to engineering.

As time passed, this processing concept was enlarged to include engines, propellors, instruments, accessories, and electronic gear, all of which greatly compounded the problem of maintaining a high quality standard within the department. Realizing that inspection alone was not the answer to controlling quality under the Interim Rework process, the Bureau of Aeronautics, working with the different Overhaul and Repair Departments, brought out the Quality Control Program.

The Quality Control Concept

Quality Control was considered a management tool in the same sense as Production Control, Cost Control and Material Control were management tools. From the viewpoint of the Bureau of Aeronautics:

> The basic concept of Quality Control for Overhaul and Repair Departments is primarily the establishment of a program, the functions of which will reasonably insure the coordination of material, men and machines in such a manner as to detect difficulties, prevent recurrences, and provide an effective measure of assurance to product reliability. Essentially the degree to which the activity products are refined by work processes directly reflects the efficiency and value exercised on the control of quality. It must be borne in mind that "excess quality" or "unnecessary refinement" can be costly in time and material and greatly effect the objectives of Quality Control, as well as insufficient processing can adversely effect the desired standard. In order to place Quality Control in the proper perspective, it must be realized that purely statistical control measures are not adaptable to the variations in Overhaul and Repair Department workloads because of the individuality of components considered under the "depth of overhaul concept." Therefore, it must be remembered and emphasized that a practical approach to controlling quality must be made. The most practical method has been found to be by investigation of circumstances surrounding discrepant workmanship and/or material failures. The collection of pertinent information, compilation of factual data records will provide a means of improving practices, assure necessary specific instructions and aid in promptness of communications. Quality Control is a staff function, the proper performance of which requires the authority and assumption of responsibility for action. Quality Control necessitates cutting across organizational lines at division level and below throughout the Department, in order to determine facts, develop case histories, compile data, and make possible comprehensive reporting with which Management may take corrective action.[2]

The Quality Control Manual

The Quality Control Manual, issued by the Bureau of Aeronautics on August 13, 1959, provided the philosophy, organiza-

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[2]Quality Control Manual for Overhaul and Repair Departments at Naval and Marine Corps Air Stations, BUAER Instruction 5214.1, August 13, 1959, p. 2.

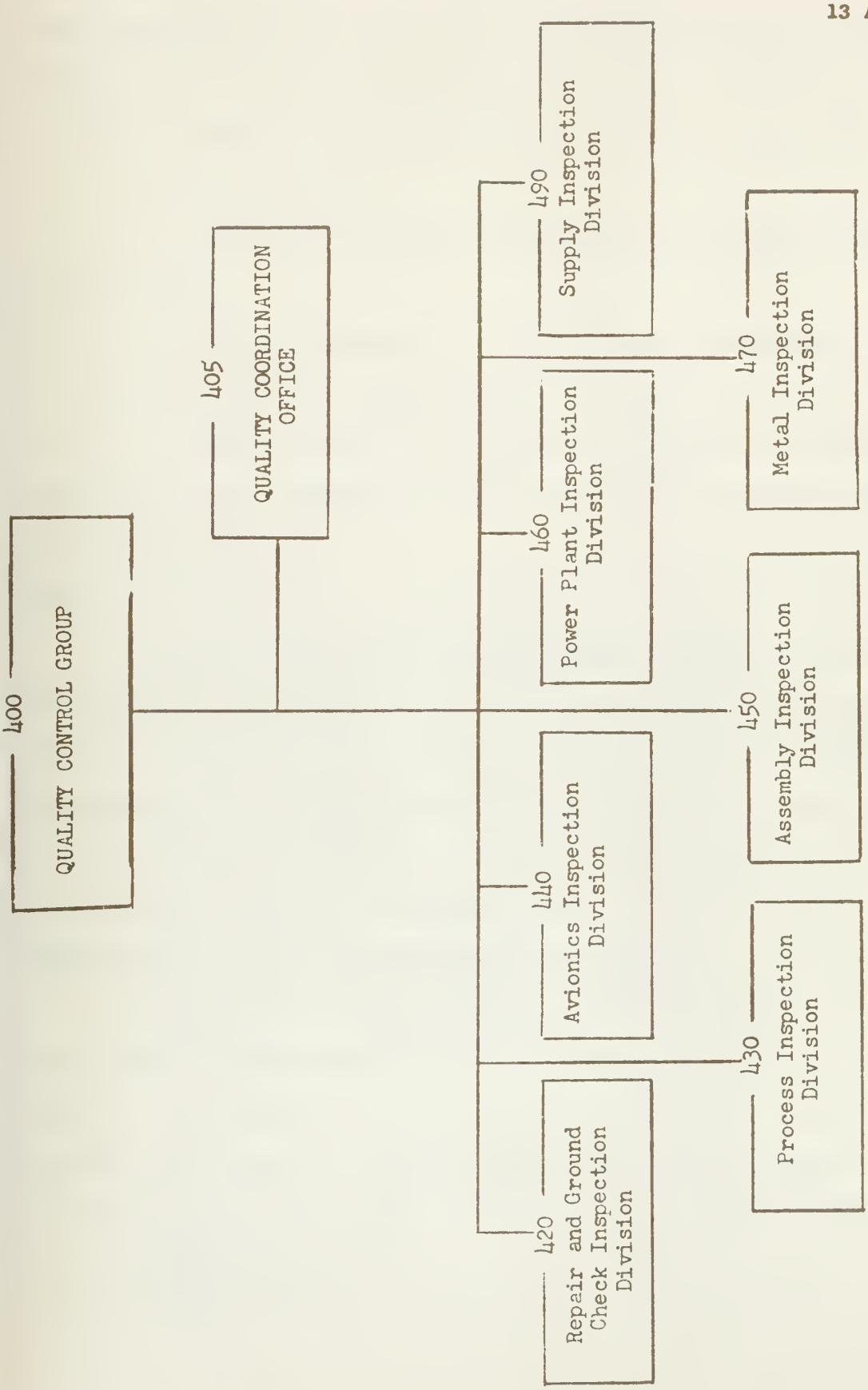
tional considerations, outline of the basic system, and management considerations surrounding the design of a Quality Control Program. The contents allowed the activities necessary leeway inpreparing local detailed implementing directives. The over-all objective of the manual was to "provide the stimulus by presenting the general framework of a Quality Control System to challenge all Overhaul and Repair Department personnel to show by their actions that quality consciousness prevails throughout the entire Overhaul and Repair Department."

It indicated management's view that quality of products produced had to be controlled and that instances of poor quality, for whatever reason, should first be corrected and reasons for the poor quality analyzed to eliminate the cause. The analysis would automatically indicate the responsibility for the discrepancy.

The Manual established a general pattern for gathering, analyzing, and reporting information concerning the quality of products. Each activity, because of local peculiar characteristics, was authorized to apply these procedures to conform with local conditions, but it was desirable for all to adhere to the basic concepts and principles contained in the Manual so that there would be uniformity in the techniques applied. The closer the Manual was followed, the better would be the comparison of data and exchange of information concerning the quality of products between the activities.

Objective of the Program

The objective of the Quality Control Program was to pin-point problem areas and provide sufficient factual information to


400
QUALITY CONTROL GROUP
405
QUALITY COORDINATION OFFICE
420
Repair and Ground Check Inspection Division
430
Process Inspection Division
440
Avionics Inspection Division
450
Assembly Inspection Division
460
Power Plant Inspection Division
470
Metal Inspection Division
490
Supply Inspection Division

which management could make decisions and reply. The implementation of the program was designed to:

1. Improve quality and reliability of material.

2. Reduce costs.

3. Minimize production problems and prevent similar occurrences.

4. Improve inspection and processing methods.

5. Stimulate quality and cost consciousness.

6. Assure product reliability by increasing knowledge and improving work processes to meet production schedules with dependable units.[3]

Scope

Conventional statistical quality control methods were only applicable to an Overhaul and Repair Department in certain special cases. As a result this program was developed on a few basic principles such as improvement of product reliability, reduction of costs, the improvement of supervisory skills, and the renewal of employees pride of accomplishment.[4]

Organizational and Functional Relationships

The Quality Control Program provided factual information on quality of workmanship and product to management. Since the Quality Control function was that of a staff, the responsibility for producing quality products remained with the Shops Group.

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[3] Ibid., p. 3.

[4] Ibid., p. 3.

Paralleling the fundamental responsibility of the Shops Group in this regard, the Quality Control Group ascertained that workmanship of production personnel met applicable specifications, that causes of poor workmanship were determined, and that such information was reported to appropriate levels of management.

A close coordination of production and inspection procedures was necessary to assure the meeting of schedules with an acceptable product. Shops Group and Inspection Group personnel shared the responsibility for high productivity on one hand and high quality on the other.

> Progressive inspection and correction of discrepancies should be performed simultaneously, in order to avoid reprocessing while at the same time progressive production improvements should be instituted to avoid repetitions of discrepancies. Since the Quality Control Group is a service organization for the Shops Group, it should conduct inspections in a manner which does not jeopardize production schedules.
>
> In harmony with this concept, the Quality Control function becomes an essential element of the production-inspection procedures. At the point where the inspection function is accomplished, it is the responsibility of the Quality Control Group to complete the cycle in the communication of information concerning quality, cost, discrepant material, and work which fails to meet specifications. Without such information, management cannot hope to evaluate and control quality, reliability, and cost of their output.[5]

Quality Control had to blend with the interests of the total organization. Management had to realize that "quality was everybody's business" and responsibilities for it existed in every section of the organization. Furthermore, the Quality Control

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[5]Ibid., p. 4.

Program encompassed prevention as well as correction of discrepancies. Responsibilities of the different Groups toward the Quality Control Program were stated as

a. ADMINISTRATIVE SERVICES GROUP. Has responsibility for organized employee training. Takes corrective action on problems of quality revealed by the Quality Control Program and attributed to this group's functional area of department responsibility.

b. MANAGEMENT CONTROLS GROUP. Has responsibility for coordinating the design elements for the Management Controls System including the Quality Control Program. Reviews and approves installation of these systems. Provides statistical and cost data as required. Takes corrective action on problems of quality revealed by the Quality Control Program and attributed to this group's functional area of department responsibility.

c. AERONAUTICAL ENGINEERING GROUP. Releases specifications concerning work to be processed. Provides engineering services to correct quality discrepancies including those revealed by the Quality Control Program.

d. QUALITY CONTROL. Determines inspection requirements. Inspects work and materials in accordance with applicable directives and specifications. Conducts the operating phases of the Quality Control Program to determine cuases of substandard quality, to initiate and follow-up on corrective action where other groups are involved, and to improve the Quality Control procedures. Takes corrective action on problems of quality revealed by the Quality Control Program and attributed to this group's functional area of department responsibility.

e. PRODUCTION PLANNING GROUP. Plans, prepares, and releases schedules of work to be performed; performs the E&E function; determines material availability and requisitions materials required. Following the reporting of discrepancies, this group reschedules items requiring reprocessing and takes corrective action to eliminate problems of quality attributed to the Production Planning Group's operations.

f. PRODUCTION ENGINEERING GROUP. Determines where work to be processed will be performed by identifying components of work, establishing routing sequences, process time, skills, required materials and facilities, and by setting labor standards. Provides revised production operation sequences and plant layout as necessary to eliminate quality discrepancies revealed by the Quality Control Program.

g. AIRCRAFT TRANSFER GROUP. Consolidates correct log book information for completed end products. Provides aircraft upkeep services. Takes corrective action on problems of quality revealed by the Quality Control Program and attributed to this group's functional area of department responsibility.

h. SHOPS GROUP. Performs specified shop work in accordance with all applicable work specifications. Takes corrective action to eliminate causes of substandard processes such as faulty workmanship or unwarranted disposal revealed by the quality control processes. Provides basic labor cost data on the cost of correcting discrepancies.[6]

Functions of the Quality Control Group

The Manual prescribed the following functions for the Quality Control Group:

1. The Quality Control Group is assigned responsibility for the implementation and operation of the Quality Control Program. Within the scope of this responsibility is the maintenance and operation of the departmental control point for all quality control information, the coordi ation and collection of necessary data, the assimilation, analysis, interpretation and reporting of these data and the preparation of quality control directives. These responsibilities are vested in the Quality Coordination Office.

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[6]Ibid., p. 5.

2. The assignment of this Quality Control function calls for the Quality Control Group to stimulate the following lines of thought and action in all personnel concerned:

a. Concentrate on analysis and correction of problems.
b. Become auditors of the practice of quality rather than restrict functions to inspection of the finished product.
c. Provide on-the-spot analysis of defects, find the cause and recommend appropriate corrective action.
d. Feed-back facts about defects for correction by cognizant groups.
e. Develop cost-consciousness and submit recommendations on ways and means to maintain or increase quality at reduced cost.
f. Recognize production, planning and engineering problems, and wherever possible, assist in finding a satisfactory solution.

3. This concept of full Quality Control gives the individual inspector and the Quality Control Group a positive role in assisting other members of the Overhaul and Repair Department toward attaining goals in quality improvement, the reduction of production costs and maintenance of production schedules. It spells out not only the responsibility of the individual inspector for detecting and reporting discrepancies in material but also the authority and responsibility for reporting other problems coming to his attention which may lower the quality or increase the cost of end products.

4. To be effective agents of quality control, inspectors must be consistent in reporting discrepancies and must not reduce the intensity of their inspection or change their reporting practices unless so authorized or instructed by higher authority.[7]

The Quality Control System[8]

The Quality Control system was "designed to encompass the principle of total Quality Control." Through use of this system,

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[7]Ibid., p. 6.

[8]Ibid., p. 8.

management based its decisions on facts pertaining to the complete picture and not on fragmentary data.

The processing shop personnel, including the inspectors, furnished initial information on the condition of items returned for re-processing. Action taken to prevent recurrent of similar deficiencies was included in the report. Responsibility for monitoring conditions causing items to be returned for re-processing remained with the processing area, unless it was determined that another specified shop or service group was responsible.

The Shops Group and Quality Control Group were considered the primary source of internal quality information. The data collected furnished management with

> 1. In-process discrepancies which are defined as material considered non-acceptable by inspection personnel during the routine inspection of materials being processed, which does not meet current applicable technical directives or contains faulty and/or incomplete workmanship.
>
> 2. Re-processed items are those previously accepted as satisfactory, which during subsequent use or test in another shop are found to contain defective parts or workmanship and are physically returned to the responsible feeder shop for correction.
>
> 3. Material classified as "Beyond Economical Repair", or "Beyond Repair" which is being scrapped because of controllable causes such as faulty workmanship, materials damaged by abuse, unrealistic standards, etc. Defined as Material Review Board actions.[9]

In-Process Discrepancies

The primary responsibility for monitoring conditions which caused discrepancies was assigned to the major Division

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[9]Ibid., p. 8.

Groups within the Overhaul and Repair Department by the type of discrepancy found.

1. The Production Planning Group monitored discrepancies caused by Control Centers, Transportation, Examination and Evaluation and Manufacturing Planning Branches.

2. The Shops Group determined when the required work was not accomplished to the extent necessary to assure operational reliability of the product. It also determined when the work was sub-standard.

3. The Aeronautical Engineering Group monitored discrepancies caused by erroneous technical instructions and drawings.

4. The Quality Control Group monitored conditions which permitted defective material to pass inspection points.[10]

Source Data for In-Process Discrepancies

Inspection personnel originated appropriate discrepancy documents whenever a discrepancy was found. The shop inspector and shop supervisor monitored the reliability of all discrepancy documents and time changes Inspection personnel also originated a separate document for each category of discrepancy in order to account for responsibility when multiple discrepancies occurred.

Shops group personnel recorded the direct labor used in correcting the discrepancy document. The completed document and material affected were resubmitted to inspection for final passage. The completed document contained all information necessary for identification of the defective part, the cause of the discrepancy, the area or areas of responsibility and any other information required to describe the reported defect.

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[10] Ibid., pp. 9, 10.

All In-process discrepancy documents were forwarded to the Quality Control Division. To denote the seriousness of the discrepancy the inspector classified each discrepancy as either critical, major or minor as defined by MIL-STD-105.[11]

Re-Processed Items[12]

The Shops Group and/or Quality Control Group personnel of the initiating shop were responsible for assisting the Production Planning Group in preparing "Re-processed Item" documents. Where applicable, the Production Planning Group personnel entered the essential information on the re-processed item document when an initiating shop found it necessary to send items to a responsible shop for testing, repair, or overhaul.

The processing shop of the Shops Group examined and determined the extent of reprocessing required, and coordinated with the initiating shop when it was required or desirable to exchange technical information. The processing shop conducted test or repair necessary to assure the reliability of the item, recorded the direct labor used, and entered an accurate, concise statement concerning the condition found and action to be taken to prevent recurrence. The shop indicated whether the defect was its responsibility or was caused by an external shop. Upon competion of the necessary work, the item was returned to the control center for routing.

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[11] Ibid., pp. 10, 11.

[12] Ibid., p. 11.

The Quality Control Group of the Processing Shop reviewed comments on the Re-processed item document for clarity, completeness and accuracy and indicated concurrence or non-concurrence with the statement made. In the event of non-concurrence, an explanatory statement was entered on the Re-processed item document.

To reduce errors in source information and assure maximum accuracy of statistical data, the shop supervisor and the shop inspector were charged jointly with the responsibility for the accuracy of time and technical decisions for all Re-processed items.

Material Review Boards[13]

The Overhaul and Repair Department had control over the costs of parts or materials damaged by abuse, extravagant use of replacement parts, faulty workmanship or the unwarranted disposal of repairable items. "Lower operating budgets dictate that all possible savings must be realized and the losses in this area must be isolated and minimized." Therefore the Material Review Board members were cautioned to exercise due consideration in the surveillance over "scrap can" bits and pieces as well as the larger and more expensive accountable items.

Controllable scrap consisted of "articles manufactured by the Overhaul and Repair Department that do not conform to current specifications; parts damaged through accident or carelessness; and/or the unwarranted disposal of parts which are economically repairable."

Non-controllable scrap consisted of "articles or parts which have become unserviceable due to normal wear and tear; machine set up scrap and experimental material."

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[13] Ibid., p. 12.

A Senior Material Review Board was activated and composed of representatives of cognizant Groups. This Board formulated policies under which subordinate boards operated and rendered decisions on the disposition of material when a unanimous decision could not be reached by subordinate Boards.

> Subordinate Material Review Boards will service the shops in each branch of the Shops Group. Each Board shall be composed of 3 members, one from each of the following groups: Quality Control Group(400) chairman; Shops Group(1000) member; Production Planning Group(500) member. The Shops Group member shall be the cognizant branch supervisor. Other members shall be drawn from the corresponding level in their respective group segments.
>
> a. Personnel from shops involved, engineers or other appropriate personnel will be called upon as necessary in order to assure that Material Review Board Decisions are consistent with operating procedures and technical directives.
>
> b. Decisions of the subordinate Material Review Board must be unanimous on the disposition of the material. A brief report shall be prepared by the chairman and forwarded to the Senior Material Review Board when the decision is not unanimous. The Senior Board shall then make disposition of the material, sign the appropriate documents and forward the information to the Quality Control Division.[14]

Compilation and Analysis of Source Data[15]

> The concepts:
>
> a. The individual Shops Group supervisor should be recognized as a key man in the Quality Control system. The improvement of quality begins with his leadership and direction. It is for this reason that the

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[14] Ibid., p. 14.

[15] Ibid., pp. 16, 17.

Quality Control System must not recognize routine discrepancy source data as valid information if it does not contain the signature of a shop supervisor.

b. Processing Shop (feeder shop) supervisors and inspectors are responsible for furnishing initial information on the condition of items returned for re-processing and the action necessary to prevent recurrence of similar deficiencies. Quality Control will accept processing shop statements and assign responsibilities concerning re-processed items on the strength of this information.

c. When the processing areas indicate that some other area or service group is at fault concerning the reprocessing of an item, Quality Control will assign the responsibility for further action to the specified area or group.

The compilation:

a. In-process, Re-process and Material Review Board action source data will be reviewed by Quality Control for completeness and accuracy. Data containing apparent inaccuracies will be returned to responsible personnel for re-evaluation.

b. The Quality Control Group working in cooperation with the Management Controls Group manhour clerks should prepare appropriate work sheets by shop that will document a progressive posting of man hours and the discrepancy classification that were used for the correction of In-process and Reprocess defects. The total direct manhours used in the reporting shops should also be posted, along with the manhours. This latter posting is already an inherent aspect of the Overhaul and Repair Department Management Control System.

c. At the close of a selected reporting period all manhour totals should be converted to Dollar Costs by multiplying manhours by the Overhaul and Repair average pay rates. Discrepancy costs are divided by total direct labor costs and the resulting ratio is subtracted from one and multiplied by 100%. The resulting percentage value, termed a Quality

> Control Factor, will be a measurement of qualitative efficiency within the Overhaul and Repair Department.
>
> $$1 - \frac{\text{Discrepancy Labor Cost}}{\text{Total direct labor cost}} \times 100\% = \text{QCF (Quality Control Factor)}$$

Quality Control Internal Reports

The data contained in In-process, Re-process and Material Review Board elements of the program was combined into one report and published periodically.

> The report defines the "Dollar Cost Concept" into a ratio of discrepancy labor cost to the cost of direct labor. This percentage value, termed a Quality Control Factor (Q.C. Factor) is used in all segments of the Overhaul and Repair and will apply equally well whether considering the discrepancy rate (cost) per man, shop, branch or division. It provides an accurate index for determining the degree of management action which should be taken.[16]

Local Design Consideration

The Quality Control Program was promulgated at the Overhaul and Repair Department Quonset Point on December 15, 1959 and followed the general pattern prescribed by the Quality Control Manual. The following significant aspects of the manual were included in the program:

1. The name of the Inspection Group was formally changed to the Quality Control Group.

2. A Quality Coordination Office was established as a staff office to the Quality Control Group.

3. The operation of the system to document discrepancies and their underlying causes was vested primarily in the inspector who initiated the source data upon which the system was founded.

4. Re-processing of work because of a discrepancy was performed in accordance with existing production control procedures.

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[16] Ibid., p. 17.

5. Identification, collection, and tabulation of manhours and costs associated with the re-processing of work because of a discrepancy was performed in accordance with existing manhour and cost collecting procedures.

6. Preparation and analysis of quality control reports was performed by the Quality Coordination Office.

7. Management action to correct the causes of discrepancies is vested in the line organization directly responsible for the discrepancy.

8. Overall monitoring of the system design and the necessary integration considerations with other management programs is vested in the Management Control Group.[17]

Collateral Reporting

In addition to the basic system and the periodic reporting of In-process, Re-process, and Material Review Board information the Quality Control Program consisted of the situation type reports which were developed on a non-routine basis. These reports are found in Appendix B.

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[17]Ibid., p. vii.

CHAPTER V

SUMMARY

> A Quality Control Program provides a systematic and efficient method of gathering and maintaining information on the quality characteristics of products, the source and nature of defects, and their immediate impact upon the current operations. It permits decisions to be based on facts rather than intuition or memory. It will provide comparison data which will be useful long after the details of given periods are forgotten. Since Management is responsible for corrective action, the success of the Quality Control Program depends upon the manner in which they utilize the information given them. Any successful application requires the concerted effort of management. Teamwork must be cultivated and achieved before any substantial benefits can be obtained.[1]

The Tentative Manual for the Inspection and Survey Department of 1945 indicated that "While quality is of primary importance to the inspector, he must realize also that the quantity of aircraft completed...is of equal importance and he must cooperate in every respect to maintain production."

When the Inspection Department became a part of the Overhaul and Repair Department in 1948, little was done to

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[1]Ibid., p. 3.

establish communications along the line of a quality reporting system. Inspection's mission was merely to determine "the qualitative results of production operations and, if sub-standard, recommend to appropriate levels of management that corrective action to be taken."

The inspector was at all times "in the middle" on the question of quality. On the one side was the worker who expected him to pass the work, quality or no quality. On the other side was the "Fleet" represented by the pilot who expected him to pass nothing but the very best workmanship. And on a third side was management with the desire for the greatest production record, the finest reputation for quality of product, the lowest cost per unit produced, and above all a "happy ship."

It frequently happened that the only time that concern was shown in the quality area was when the rejection rate reached unusual proportions -- when aircraft stopped flying or engines failed to roll off the assembly line on schedule.

Through the inspection methods devised, Overhaul and Repair Department's Management maintained a measure of control over quality, but with the great technical advances in overhaul procedures of the last decade it

> found that the product quality would frequently drift to an extreme before it was called to the attention of management. Adverse quality trends were not detected until they had reached critical proportions. There was a need for keeping a finger on the pulse of production at the working level in order that variations in product quality would be detected at the earliest possible moment and appropriate action be taken to correct abnormal conditions at their source. For many years

> inspectors have charted and tabulated various kinds of discrepancy information. Very few of these efforts, however, were related to overall quality and cost considerations. The need for quality control on a departmental scope was recognized by the Bureau of Aeronautics, and prototype programs were sponsored at several activities.[2]

Quality Control concerned the management principle that

> management's authority is not completely exercised until it has checked compliance with its orders through the use of controls. Control is the process of assuring that performance corresponds with plans. Standards are the measurements used for control. When orders are accompanied by instructions, performance is being guided by the standards contained in, or suggested by, the instructions. These stated or implied standards can be used to measure or control performance. Control provides the means for determining whether or not, and to what extent, all the subdivisions of the organization are performing the functions assigned to them, and in the manner provided. It is a form of management inspection which measures performance against established standards. Effective control is practically unworkable under any system of divided responsibility. Centralized management control of properly grouped and delegated functions is the directing principle, while integrated responsibility is the tool by which control is effected. Standards are necessary for control, and controls are necessary for balanced and coordinated management.[3]

The Purpose of Control

Control was established as an aid to management in making correct decision in a shorter time than it has in the past.

> Time is of the essence for action based on controls. Since control has a distinctly scientific approach, it is a

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[2]Ibid., p. 1.

[3]Henry G. Hodges, Management-Principles, Practices, Problems, (Cambridge, Massachusetts: The Riverside Press, 1956) I, 71.

> keener management tool than the methods which it replaces. Control is preceded by a collection of the facts bearing on a specific problem; these facts are passed on to management with recommendations based on their analysis and synthesis.
>
> Controls are the guiding factors of business; they are the warning signals for management; they are one of the important bases for scientific management. Because they are all of these, they are an essential substitute for rule-of-thumb decisions. Properly planned and used, controls are the indicators or acceptable standards for production, finance, sales and numerous other activities. Over a period of time they mark out the path by which the present situation was reached in any activity subjected to their restraints. They supply experienced human judgement with an opportunity for charting the path ahead by indicating the means and methods for following that path.[4]

The Management Control Center

The introduction of the Management Control System into Overhaul and Repair Department organization integrated the use of all business techniques for controlling movement, manpower performance and cost of work. This was a centralized control center developed to bring all control activities into a single unit and "improve the balance and coordination between staff and line functions, thereby minimizing unhealthy rivalries and duplication of effort and, at the same time, affecting operating economies."

Management Control had been devised

> to find out the facts and recommend action to management. Its activities are those of an advisory staff, with no line powers

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[4] Ibid., p. 159

> of action. It aids management by analyzing its findings and suggesting remedies where faults are discovered. It aids communications -- when executive members of the line so order -- by issuing directives in management's name. Planning, forecasting, methods-engineering, and internal audits may all be considered phases of the central control section's duties.[5]

Management Service

The rendering of integrated "Management Service" by one segment of an organization to all of its segments has, over the years, been called Management Engineering, Management Control, Industrial Management, Management Staff, Cost Control, etc. The new Overhaul and Repair Department organization featured the identification of this single segment at the "Management Controls Group."

The Management Controls Group was assigned the full responsibility for the design and installation of the Management Control System. The exercise of this responsibility was not confined to the limits of the Management Controls Group, but also included certain technical aspects of management control pertinent to the design and installation of the System. In general, these technical aspects were identified as those which make the integration of all Management Improvement Programs possible and which linked the various points of responsibility for these programs. Specifically, such technical aspects were:

1. The design or the format of all forms, records, and reports for identifying and recording detailed and group data.

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[5]Ibid., p. 170.

2. The scheduling of the System's installation by program and area.

3. The establishment of code series for identifying programs and work unit processing.

4. The conduct of training sessions or seminars on the System's operation.

5. The preparation of all graphic or narrative publications pertaining to the design, installation and operation of the System.[6]

The Mission of the Management Controls Group:

Prepares organizational charts, policy and functional statements, and all departmental instructions (May Directives System) on responsibilities and procedures for the entire department and reviews and certifies the proper alignment and adequacy of all departmental supervisory position descriptions. Prepares plans and pre-survey and post-survey instructions, including reports thereon specified by internal authorities or conducted by external authorities. Conducts training sessions and seminars on all phases of management controls. Prepares all illustrative or narrative publications pertaining to conferences, the O&R Department Management Control System or any special project concerned with departmental management controls. Designs and installs the O&R Department Management Controls System, which integrates all Management Improvement Programs through the application of improved business administration techniques. Designs forms, records, reports and code series used for identifying, routing and reporting management facts and data and the procedures relating thereto. Insures effective utilization of office equipment which is used to create, process or store departmental records. Analyzes personnel ceiling requirements and recommends to the Assistant Overhaul and Repair

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[6]Management Control System Manual, Buaer Instruction 5200.11, October 10, 1956.

> Officer the allocation thereof to organizational units. Prepares the departmental master budget, develops all supporting financial accounting and budgeting procedures for the entire department (including the administration of regulations and the preparation and maintenance of monetary reports and records pertaining thereto), reviews and certifies the availability and propriety of allotment or project requests or expenditures, and renders timekeeping and related clerical services to all production shops. Evaluates performance accomplishment of all segments of the organization, prepares internal performance summary reports for all points of departmental supervision and external reports on departmental performance and progress, investigates sub-marginal performance trends and charts performance accomplishment for all segments of the organization.[7]

Management Views Quality Control

The Bureau of Aeronautics considered management's role in the Quality Control field of paramount importance. The Quality Control Manual stated that

> Management should be vitally concerned with the weekly, monthly or quarterly reports on in-process discrepancies, re-processed discrepancies and action of the Material Review Boards. A careful analysis by management should be made of the reports submitted and management should watch:
>
> a. The rejection rate and cost of discrepancies within each shop or area.
>
> b. The nature of the defects being found.
>
> c. The group held responsible for the corrective action.
>
> d. The reason or apparent cause for any appreciable change in the percentage of material being rejected.

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[7]Overhaul and Repair Department, Quonset Point, Instruction Note 5451, February 5, 1957.

e. Other facts concerning the quality of products and production costs of which management should be advised.

f. The extent and value of material being scrapped due to faulty handling, sub-standard workmanship or other causes.[8]

From the viewpoint of management it is essential that honest and objective acceptance of responsibility be stimulated and achieved throughout the organization before the basic cause of discrepancies can be revealed and corrected.

When considering the quality level of products, top management must place emphasis on the "long haul" as well as the "here and now". The importance of dealing with individual quality problems must not minimize the importance of recognizing that the control of quality is basically a long range program, and that it involves the work of the entire organization rather than an individual part or an individual worker. The primary objective of a quality control program is to find and correct conditions causing defects rather than tolerate the correction of defects after they have occurred.[9]

Line Officer Responsibility

Line officers had the sole responsibility for taking corrective action when reports of the Management Control Group indicated unsatisfactory findings. However, here, too, the Line learned to look for advice from the Management Control Group which was almost as close to the staff and operating personnel as their own managers. An important point about corrective action under management control was that the section might often correct troublesome conditions by making direct suggestions to organization segments.

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[8]Quality Control Manual for Overhaul and Repair Departments at Naval and Marine Corps Air Stations, BuAer Instruction 5214.1, p. 19.

[9]Ibid., p. 19.

A prominent service of the Management Control Group was giving aid and advice to all departments and their subordinate units. Although this phase of control was not so directly visible to management as were faults brought out in the survey reports, any improvement in the smooth operation of the Overhaul and Repair Department was likely to be observed by the Overhaul and Repair Officer.

Quality Control Principles

Armand V. Feigenbaum in his book Quality Control-Principles, Practice and Administration has developed thirty important principles of Quality Control. These principles have been included in Appendix C.

CHAPTER VI

CONCLUSION

The foregoing history of Inspection and Quality Control in the Overhaul and Repair Department at Quonset Point presented a study of scientific management in evolution in a Navy commercial-industrial plant. The new Quality Control Program was devised to fit the need of modern management through the Management Control System with the Bureau of Aeronautics emphasizing local management's need for deepening interest in the subject.

The Quality Control Manual stressed that management "should be vitally concerned with the weekly, monthly or quarterly reports" and that "from the viewpoint of management it is essential that honest and objective acceptance of responsibility be stimulated and achieved throughout the organization."

Reporting procedure was the basic difference between the former Inspection organization and the newer Quality Control Program. The new program established a Quality Coordination Officer to "keep the score" and pass the results along to the Management Controls Group for further amplification and routing to management as well as other cognizant Groups. Under the old system much leeway was given management in designating the

inspection reporting procedure. Under the new system the reporting system had been designated from outside the Overhaul and Repair activity and the reports were available for external as well as internal consumption.

The introduction of the Management Control System indicated a shift to a controller function in Overhaul and Repair Departments. It may serve as an impetus to wider acceptance of the Controller function into Navy activities. The Management Control Officer may well be called the Overhaul and Repair Department's Controller.

This study has not concerned itself with inspector morale which has deteriorated to a critical degree since 1954 when the inspectors were taken out from under the Classification Act in Civil Service and put under the Wage Board Schedule. Specifically this meant removing them from the category of salaried employees and changing them to the status of per diem employees. A return of inspectors to salaried employee ranks would strengthen the competence of inspection workmanship within the Quality Control Group.

APPENDIX A

EXCERPTS FROM AN INTERIM REWORK INSTRUCTION[1]

Interim Rework...is a special rework performed at intermediate periods within the service tour of: (a) aircraft operating on the "calendar month" service tour concept; and (b) aircraft under the "operating month" service tour concept when such aircraft are currently operating on or planned to operate on a lengthened service tour in order to meet operating requirements. The work to be performed will include: (1) examination of aircraft to the depth necessary to reveal discrepancies that must be corrected to permit satisfactory operation for the period specified by the major operating command; (2) incorporation of changes and compliance with bulletins (determination of those to be installed will recognize availability of materials); and, (3) correction of discrepancies resulting from the examination and those specified by the operating unit.

In the broad perspective aircraft in the Interim Rework Program will normally receive such rework twice during the first service tour of thirty-eight months and once during the second tour. For planning purposes this program is based, generally, on a twelve calendar month basis for the first tour and a fifteen

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[1]Bureau of Aeronautics Maintenance Representative, Eastern District, Instruction 5442.1 dated 9 June 1958.

or eighteen month basis during the second tour. The operating interval of the aircraft is very flexible and the aircraft do not necessarily have to be turned in specifically at twelve months. Controlling custody of the aircraft remains with the major operating command.

The policies governing interim rework are not intended to limit the amount of work to a fixed number of manhours or amount of money, but rather to allow flexibility of work to be performed to remain with the custodian and the Bureau of Aeronautics Maintenance Representative to accomplish the work required. An excessive "out of service time" will void the concept of interim rework and impose unacceptable limitations on the operating activity.

Work to be Accomplished by the Overhaul and Repair Department

(1) Preserve engines on aircraft.

(2) Drain and purge aircraft fuel system.

(3) Correct specific discrepancies outlined on the work request submitted by the operating activity.

(4) Incorporate all requested aircraft service changes for which material is available.

(5) Accomplish an inspection of the airframe, control surfaces and flight controls, to the depth necessary, which shall insure continued safe operation of the aircraft for an additional twelve months provided it receives the normal squadron maintenance during this period.

(6) Correct discrepancies uncovered during processing (as agreed upon with the liaison officer).

(7) Assist in correction of flight test discrepancies. Even though this work is not included in the thirty days "in process time" limitation, it shall be accomplished expeditiously to insure early return of the aircraft to the operating activity.

(8) Refuel (fuel and oil) and depreserve engines on aircraft at the completion of Interim Rework.

(9) Ground check aircraft after completion of Interim Rework.

Inspection Criteria

(1) The quality of the inspection will be as logic dictates but will attain the proper standards in order for the aircraft to operate satisfactorily for the period prior to the next rework or overhaul.

APPENDIX B

COLLATERAL REPORTING[1]

Part A. General

In addition to the basic system and the periodic reporting of In-process, Re-process and Material Review Board information the Quality Control Program consists of the situation type reports which are developed on a now-routing basis. Following is a listing of these situation type reports, each of which is described in a subsequent part of this chapter.

a. Product Quality Audits.

b. Quality Check on Measuring Devices.

c. Material Reliability Reports.

d. Special Investigations and Projects.

e. Customer Discrepancy Reports.

Part B. Component Quality Audits

a. Quality Audits should be conducted on major components to evaluate the quality level of craftmanship and the effectiveness of inspection procedures exercised when the component was processed.

b. Quality Audit components should be selected at random at a point following final acceptance inspection and prior to use in the next operational sequence. Regular intervals for the

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[1]Quality Control Manual for Overhaul and Repair Departments at Naval and Marine Corps Air Stations, BuAer Instruction 5214.1, pp. 20, 21, 22, 23.

conduct of a Quality Audit of random components should be scheduled. When selecting an item for audit, care should be exercised to insure that the audit is coordinated with other interested personnel so that interruptions of production flow is kept to a minimum.

c. The depth of disassembly and audit will depend on the type of component being examined and the extent of evaluation deemed necessary to reach positive conclusions on the quality of the component being audited.

d. The Quality Control Group selects the item to be examined and conducts the Quality Audits. The Quality Control Analyst determines disassembly and audit procedures; classifies all defects found; and coordinates the results of the audit with Shops Group and Inspection supervisors immediately concerned.

e. The Quality Control analyst prepares a report in rough draft which includes a description of the defects found; the classification of each defect; and the corrective action taken to preclude recurrence of similar discrepancies. Appropriate recommendations are also included in this report.

f. The Quality Control Group completes the Quality Audit Reports for distribution to cognizant personnel.

g. The Shops Group provides personnel, tools and space necessary to perform the work required.

h. Defects are classified as follows:

> Class I defect. A serious defect which could cause the item to fail or malfunction before the next periodic overhaul or regularly scheduled maintenance period; and which can be found only by disassembly or partial disassembly of the item.

Class II defect. A serious defect which could cause the item to fail before the next overhaul or regularly scheduled maintenance period, but is readily detectable without disassembly.

Class III defect. A minor defect which would not cause failure or malfunction prior to the next overhaul or periodic maintenance period, but is an indication of carelessness or lack of skill used in processing the item.

Part C. Measuring Devices--Quality Check

It is the responsibility of the Quality Control Group to conduct quality checks of all test equipment, measuring devices and tools.

Part D. Material Reliability Reports

Overhaul and Repair Departments are participants in the Material Reliability Program (MRP). In addition to contributing information to the program they receive data concerning the reliability of the products they process.

To take the fullest advantage of the routine information provided by the Naval Air Technical Service Facility (NATSF), Overhaul and Repair Departments must recognize that the Reliability Program is based primarily on the collection of mass data, and that many of the reports processed do not contain information of immediate or significant importance. Each report must be handled in accordance with its apparent value and its relationship to other known facts.

1. Overhaul and Repair Departments receive information from the NATSF in the form of punched cards, microfilms and the contents of the Reliability Digest.

2. The data on punched cards must be converted to visual information before it can be used. This is accomplished by

processing the cards through standard EAM machines to obtain a tabulated listing. The "tab run" provides information on the service life of each item and is used in conjunction with the microfilm reports from NATSF to establish the extent of problem areas already under investigation by others as indicated on the microfilm reports. This analysis provides the point of departure for additional investigation of items on the tabulated listing.

3. All microfilms must be reviewed to determine if they provide information which demands further investigation.

4. Data process by the Quality Control Group will provide the following information:

a. Indications that Overhaul and Repair processed material is not performing to the standards required while in the custody of fleet activities.

b. Undesirable conditions which can be corrected before they reach epidemic proportions.

5. The receipt of data indicating either of the two above conditions will afford a basis for a review by cognizant Groups of practices and policies for conformance with applicable current directives.

Part E. Special Investigations and Projects

Overhaul and Repair Departments are frequently confronted with complex problems concerning the quality of products which require accumulation of information from several sources and which must be approached with an unbiased point of view. Some of these problems may be resolved by a single investigation while others may require lengthy monitoring action involving several investigations and a large number of observations.

Special investigations and projects will normally be initiated by management to obtain additional information not covered or furnished in periodic Quality Control reports, and may range from finding the cause of a premature failure of a single item to the faulty handling of material throughout the Overhaul and Repair Department.

When the Quality Control Group is assigned a special investigation or project, Quality Control personnel will research the problem to the extent necessary to assure that all of the pertinent facts are exposed. Where it is apparent that corrective action is required cognizant supervision is advised.

Any corrective action taken during the investigation to correct the problem and/or corrective actions pending, will become part of the report. The report will outline the problem; findings during the investigation; corrective actions put into effect; corrective actions pending; and the recommendations of the investigator.

Part F. Customer Discrepancy Reports

Customer Discrepancy reports include the miscellaneous information concerning the quality and reliability of products produced by O&R Departments. They consist of BUAER Messages, direct communications with operating activities, information from such publications as: Accident Reports; Flight Landing Incident or Ground Accident Report (FLIGA); and Reliability Digests.

These reports provide Overhaul and Repair Departments with valuable information on the over-all reliability of

finished products when operating under actual service conditions. The effectiveness of the Overhaul and Repair Departments' Quality Control Program can be measured by the frequency and content of these reports.

Each report should be investigated in accordance with its apparent urgency and importance, and precautionary or corrective measures initiated as necessary.

APPENDIX C

FEIGENBAUM'S PRINCIPLES OF QUALITY CONTROL[1]

A series of "principles" has begun to simmer out of industry's experience with Modern Quality Control.

An interpretation of these principles is presented below. It is offered as a summary of the administrative point of view toward quality control. It may also be used as a list of operating rules for organizing quality-control programs.

1. Quality control may be defined as

> An effective system for coordinating the quality maintenance and quality improvement efforts of the various groups in an organization so as to enable production at the most economical levels which allow for full customer satisfaction.

2. In the phrase "quality control" the world quality does not have the popular meaning of "best" in any absolute sense. It means "best for certain customer conditions." These conditions are (a) the actual use and (b) the selling price of the product. Product quality cannot be thought of apart from product cost.

3. In the phrase "quality control" the word control represents a management tool with four steps:

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[1]Armand V. Feigenbaum, Quality Control-Principles, Practice, and Administration, (New York: McGraw-Hill Book Company, Inc., 1951) I, 1-5.

a. Setting quality standards.

b. Appraising conformance to these standards.

c. Acting when the standards are exceeded.

d. Planning for improvements in the standards.

4. Several of the quality-control methods have been carried on in industry for many years. What are new in the modern approach to quality control are integration of these often uncoordinated activities into an over-all administrative program for a factory and the addition to the time-tested methods used of a few new techniques which have been found useful in dealing with and thinking about the increased emphasis upon precision in manufactured parts.

5. Modern Quality Control is an aid to, not a substitute for, the good engineering designs, good manufacturing methods, and conscientious inspection activity that have always been required for the production of high-quality articles.

6. The fundamentals of quality control are basic to any manufacturing process, and the tools have been and can be used in industries ranging from radios, electric motors, and turbines to bakery, drug, and brewery products. Although the approach is somewhat different if the production is job shop rather than large quantity, or small components rather than large apparatus, the same fundamentals still obtain. This difference in approach can be readily summarized: In mass-production manufacturing, they are a matter of controlling the process.

7. The details for each quality-control program must be tailored to fit the needs of individual plants.

8. The core of the quality-control approach is control of product quality during the process of design and manufacture so as to prevent poor quality rather than to correct poor quality after an article has been produced.

9. Benefits often resulting from Modern Quality Control programs are improvements in product quality and design, reductions in operating costs and losses, improvement in employee morale, and reduction of production-line bottlenecks. By-product benefits are improved inspection methods, sounder setting of time standards for labor, definite schedules for preventive maintenance, the availability of powerful data for use in company advertising, and the furnishing of a factual basis for cost-accounting standards for scrap, rework, and inspection.

10. Cost reductions are possible results of quality control for two reasons. (a) Many of the "costs of quality" result from expenditures to correct mistakes or to police them. (b) Industry has often lacked quality standards. It has therefore unrealistically tilted the scales in the balance between the cost of quality in a product and the service that the product is to render.

11. Present-day factors affecting industrial product quality have developed around two major trends:

a. Toward customer demands for greater precision in the articles they purchase -- a technological matter.

b. Toward the wide distribution of responsibility for product quality among a number of line, staff, and functional groups in contrast to the previous era,

when this responsibility was largely in the hands of the factory foreman; and toward the substitution of green operators in once-stable work groups--a matter of human relations.

12. These two trends (see paragraph 11) can be handled by Modern Quality Control so that

a. Greater precision, involving more frequent and more accurate quality measurements, may be treated by practical common-sense use of the "science of measurements" - statistics.

b. Greater distribution of responsibility for quality may be treated by new methods of organizing for quality control.

13. The factors affecting product quality may be divided into two major groupings: (a) the technological, that is, machines, materials, and processes; (b) the human, that is, operators, foremen, and other factory personnel. Of these two factors, the human is of the greater importance by far. Quality control is primarily, therefore, a matter of human relations.

14. Quality control enters into all phases of the industrial production process, starting with the customer's specification and the sale to him on through design engineering and assembly and ending with the shipment of the product to a customer who is satisfied with it.

15. Effective control over the factors affecting product quality demands controls at all important stages of the production process. These controls may be termed the jobs of quality control, and they fall into four natural classifications:

a. New-design control.

b. Incoming-material control.

c. Product control.

d. Special process studies.

16. New-design control involves the establishment and specification of the desirable cost-quality and performance-quality standards for the product, including the elimination or location of possible sources of manufacturing troubles before the start of formal production.

17. Incoming-material control involves the receiving and stocking, at the most economical levels of quality, of only those parts the quality of which conforms to the specification requirements.

18. Product control involves the control of products at the source of production, so that departures from the quality specification can be corrected before defective products are manufactured.

19. Special process studies involve investigations and tests to locate the causes of defective products and to determine the possibility of improving quality characteristics.

20. Statistics are used in an over-all quality-control program whenever and wherever they may be useful, but statistics are only one part of the over-all administrative quality-control pattern, they are not the pattern itself. The four statistical tools that have come to be used in quality-control activities are

a. Frequency distributions.

b. Control charts.

c. Sampling tables.

d. Special methods.

The point of view represented by these statistical methods has, however, had a profound effect upon the entire area of Modern Quality Control.

21. The statistical point of view in Modern Quality Control resolves essentially into this. Variation in product quality must be constantly studied -- within batches of product, on processing equipments, between different lots of the same article, on critical quality characteristics and standards. This variation may best be studied by the analysis of samples selected from the lots of product or from units produced by the processing eqipments.

22. An important feature of Modern Quality Control is its positive effect in stimulating and in building up operator responsibility for and interest in product quality.

23. Necessary to the success of quality control in a plant is the very intangible but extremely important spirit of "quality-mindedness," extending from top management right to the men and women at the bench.

24. Whatever may be new about the Modern Quality Control program for a plant must be sold to the entire plant organization so as to obtain its willing acceptance and cooperation. Participation by many members of the factory organization in developing details of the quality-control program is very desirable.

25. A plant quality-control program must have the complete support of top management. With lukewarm management support, no amount of selling to the rest of the organization can be genuinely effective.

26. Management must recognize at the outset of its Modern Quality Control program that the tool is not a temporary cost-reduction project. Only when the inefficiencies represented by the cost reductions are out of the way can the quality-control program take over its long-range role of the management control over quality.

27. Organization-wise, quality control is management's tool for delegating authority and responsibility for product quality, thus relieving itself of unncessary detail, yet retaining for itself the means of assuring that quality results will be satisfactory. The type or organization required to implement this program is a staff group reporting directly to top management.

28. From the human relations point of view, the quality-control organization is both

a. A "channel of communication" for product-quality information among all concerned employees and groups.

b. A "means of participation" in the over-all plant quality-control program by these employees and groups.

The quality-control organization is a means of breaking down the attitude sometimes held by factory operators and functional specialists that "our quality responsibility is so

small a part of the whole that we're really not a part of the plant quality-control program or important to it."

29. The duty of the quality-control staff is that of acting in an advisory and a control capacity. It usually does not have any responsibility for the actual quality-control activities, which are carried on by groups such as Engineering and Manufacturing.

30. Modern Quality Control programs should be allowed to develop gradually within a given plant. It is often found wise to select one or two troublesome quality problems, to achieve successful results in attacking them, and to allow the quality-control program to grow step by step in this fashion.

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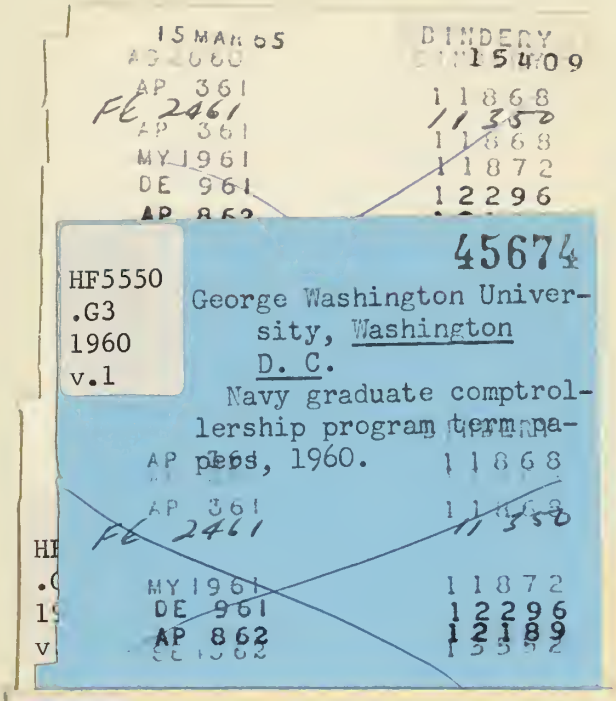
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